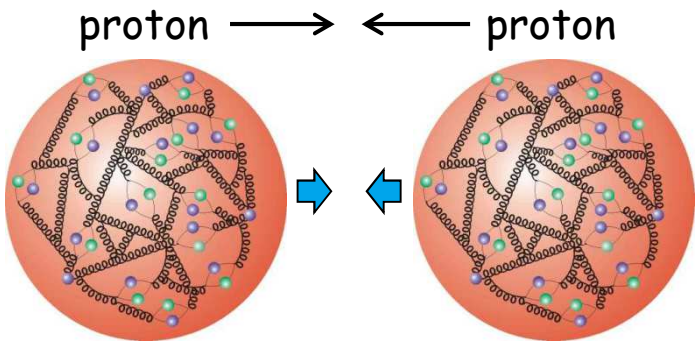
Hadron colliders versus lepton colliders

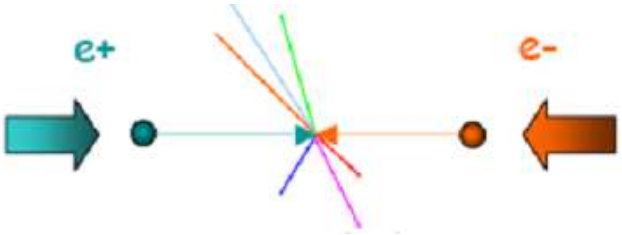
LHC (hadron collider)



collision of two composite particles
(with different initial constituents
and energies)

electroweak interactions
+ strong interactions

ILC (lepton collider)

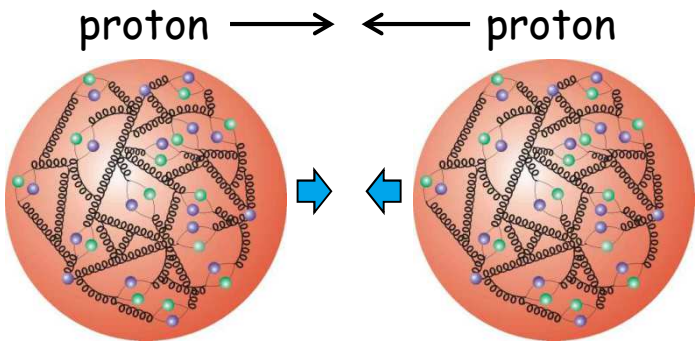


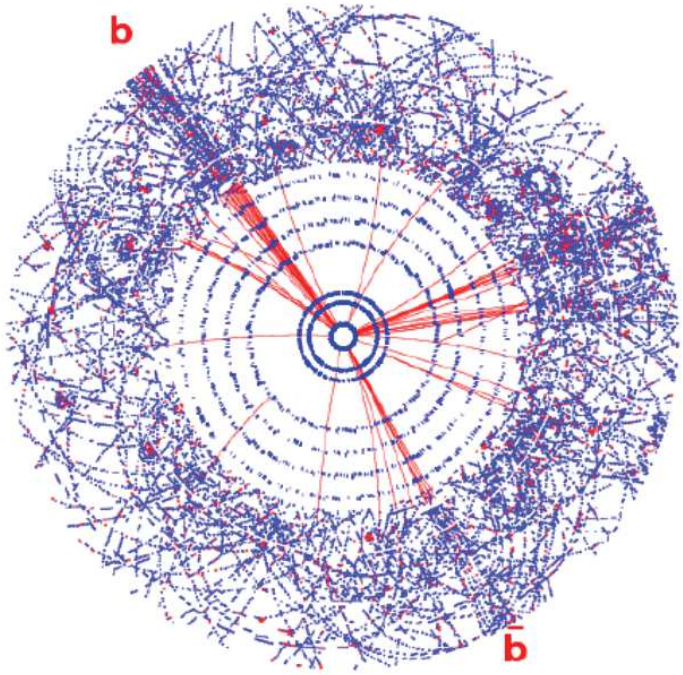
collision of two point-like particles
(with exactly defined initial state,
quantum numbers and energies)

electroweak interactions

Hadron colliders versus lepton colliders

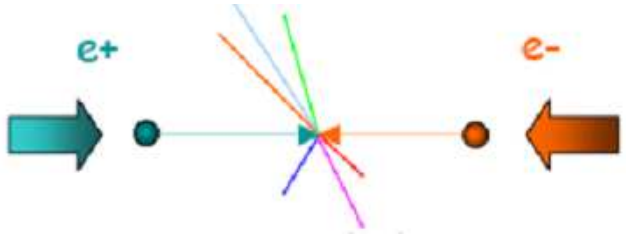
LHC (hadron collider)

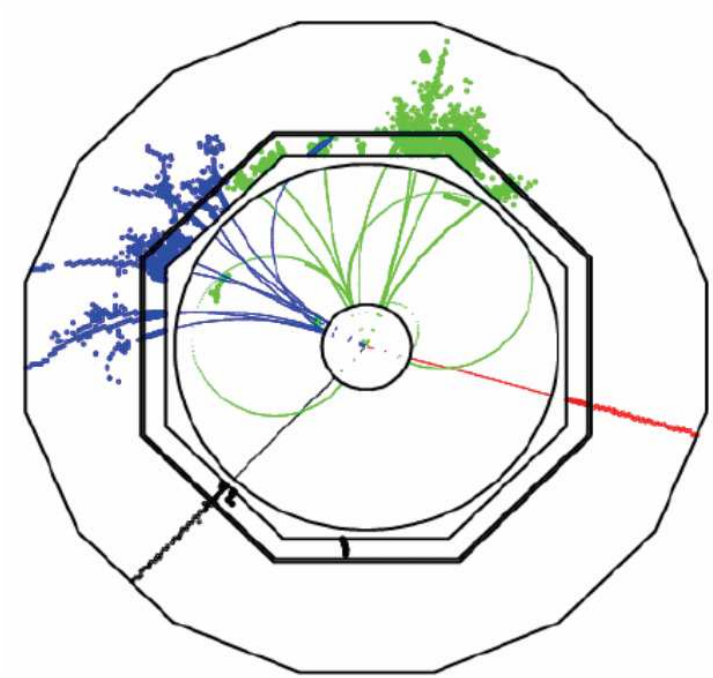




pp ➔ H + X

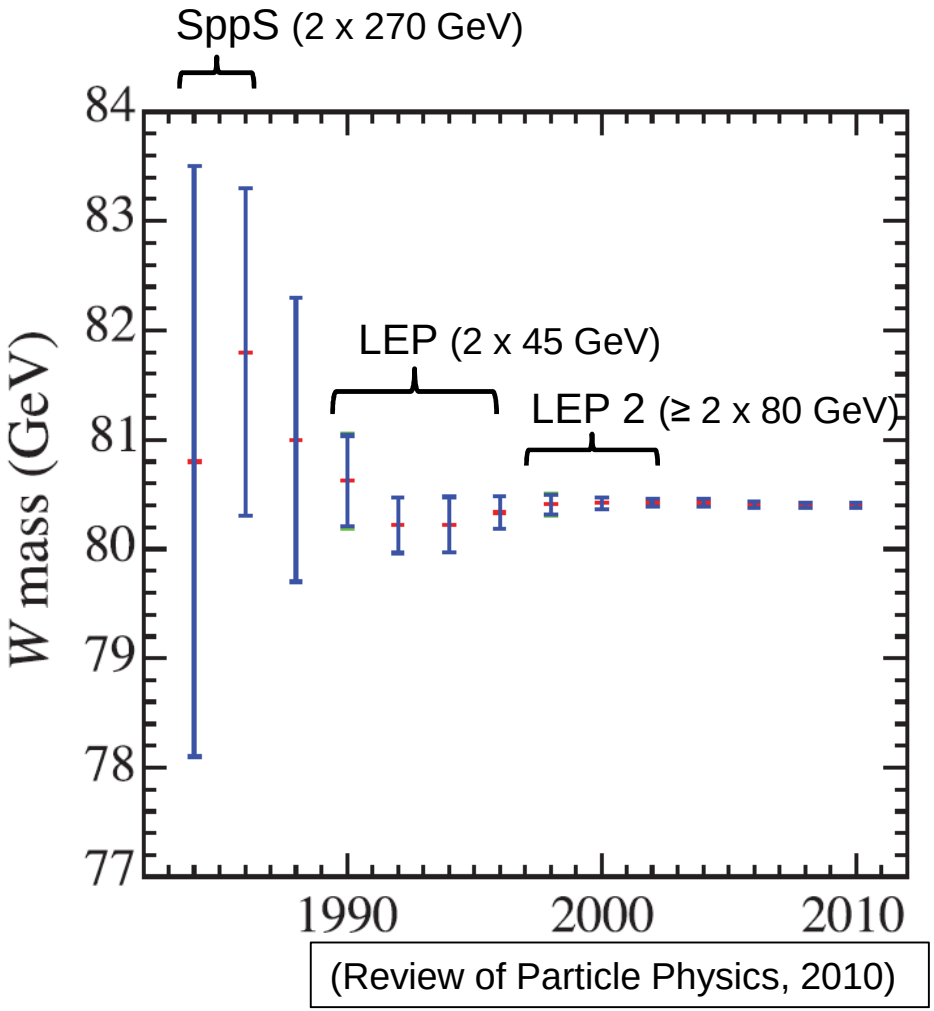
ILC (lepton collider)





e^+e^- ➔ HZ

Hadron colliders versus lepton colliders

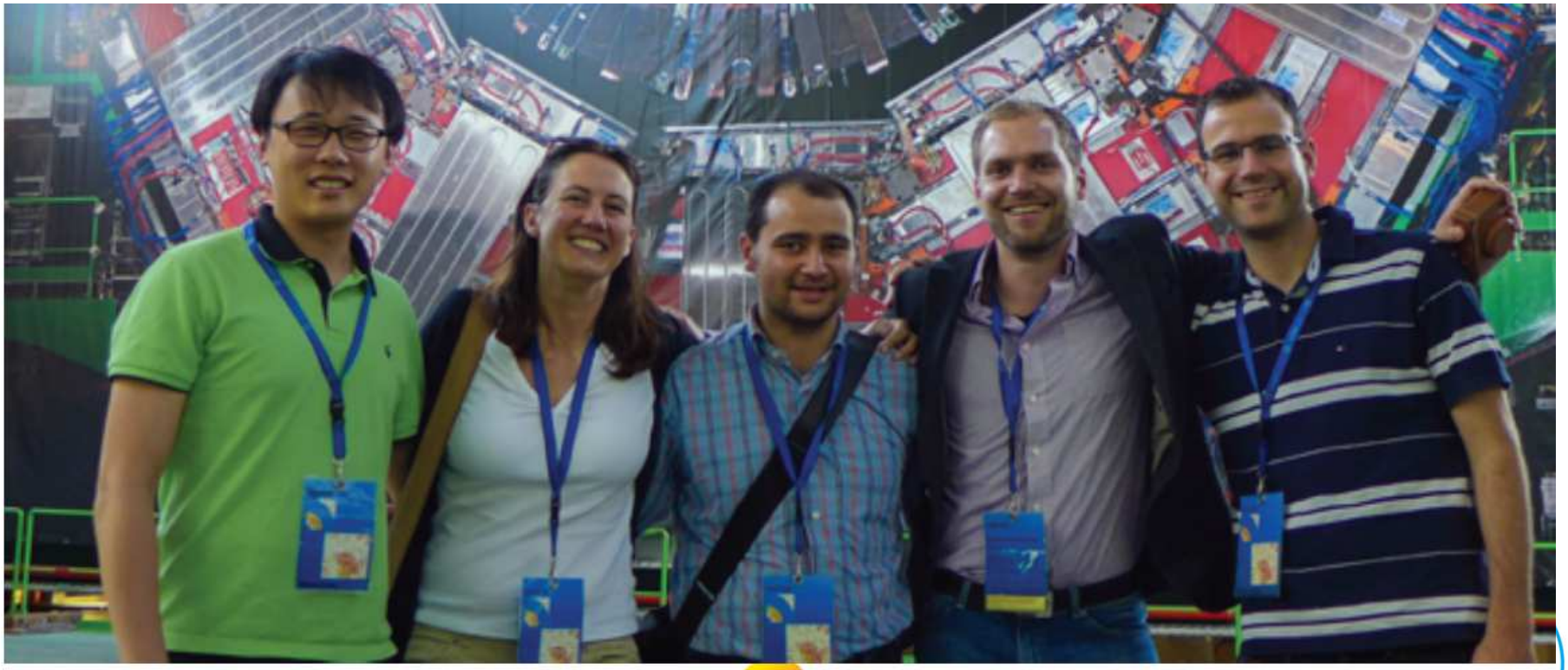


(Review of Particle Physics, 2010)

Introduction to Accelerator Physics

The Endoscopic TOFPET & Ultrasound project

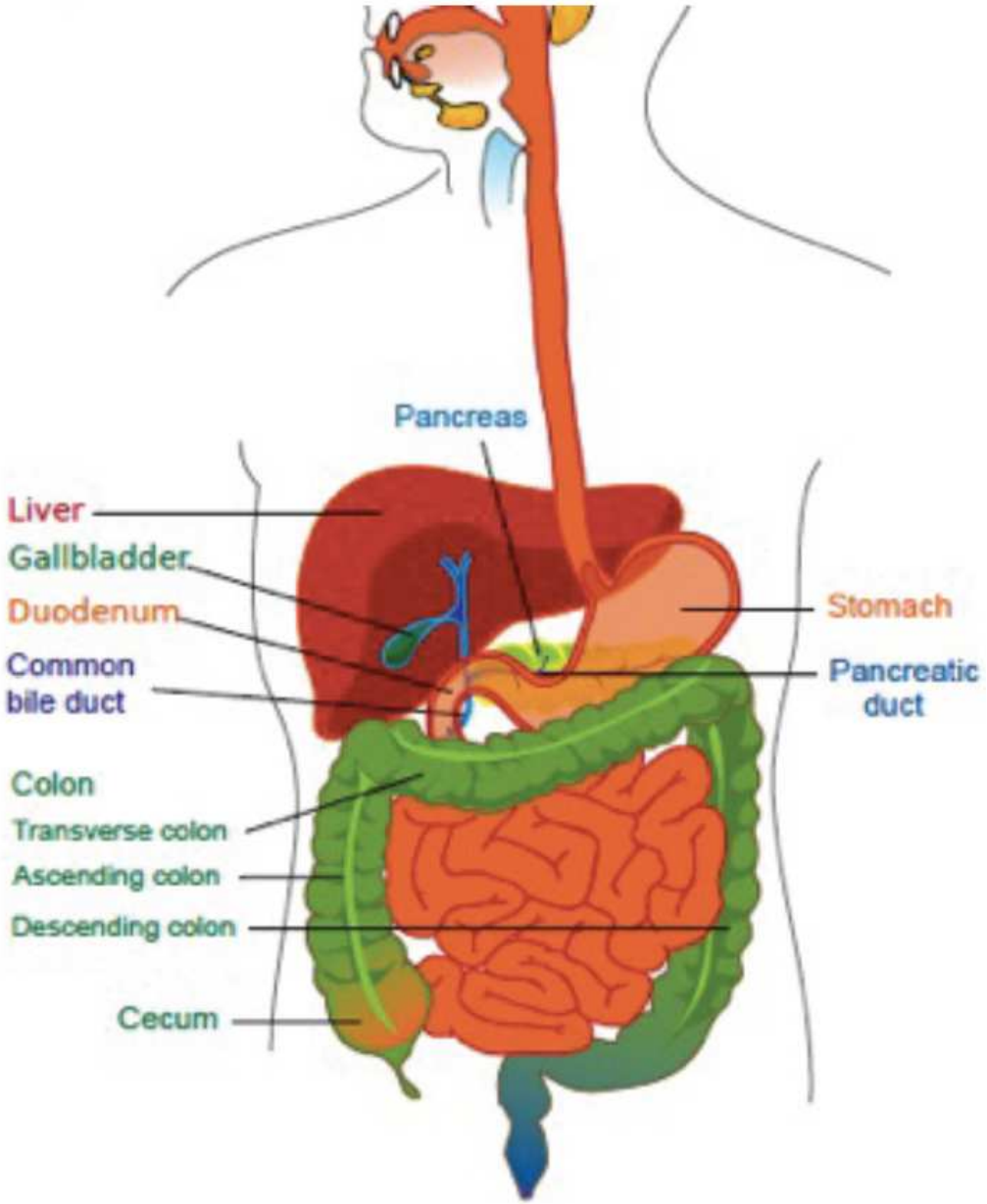
(TOF: Time-of-flight PET: Positron Emission Tomography)



Erika Garutti

ENDO TOFPET US
Endoscopic TOFPET & Ultrasound

How endoscopic PET work?



Pancreatic cancer:

4th leading cause in Western countries for cancer-related death …

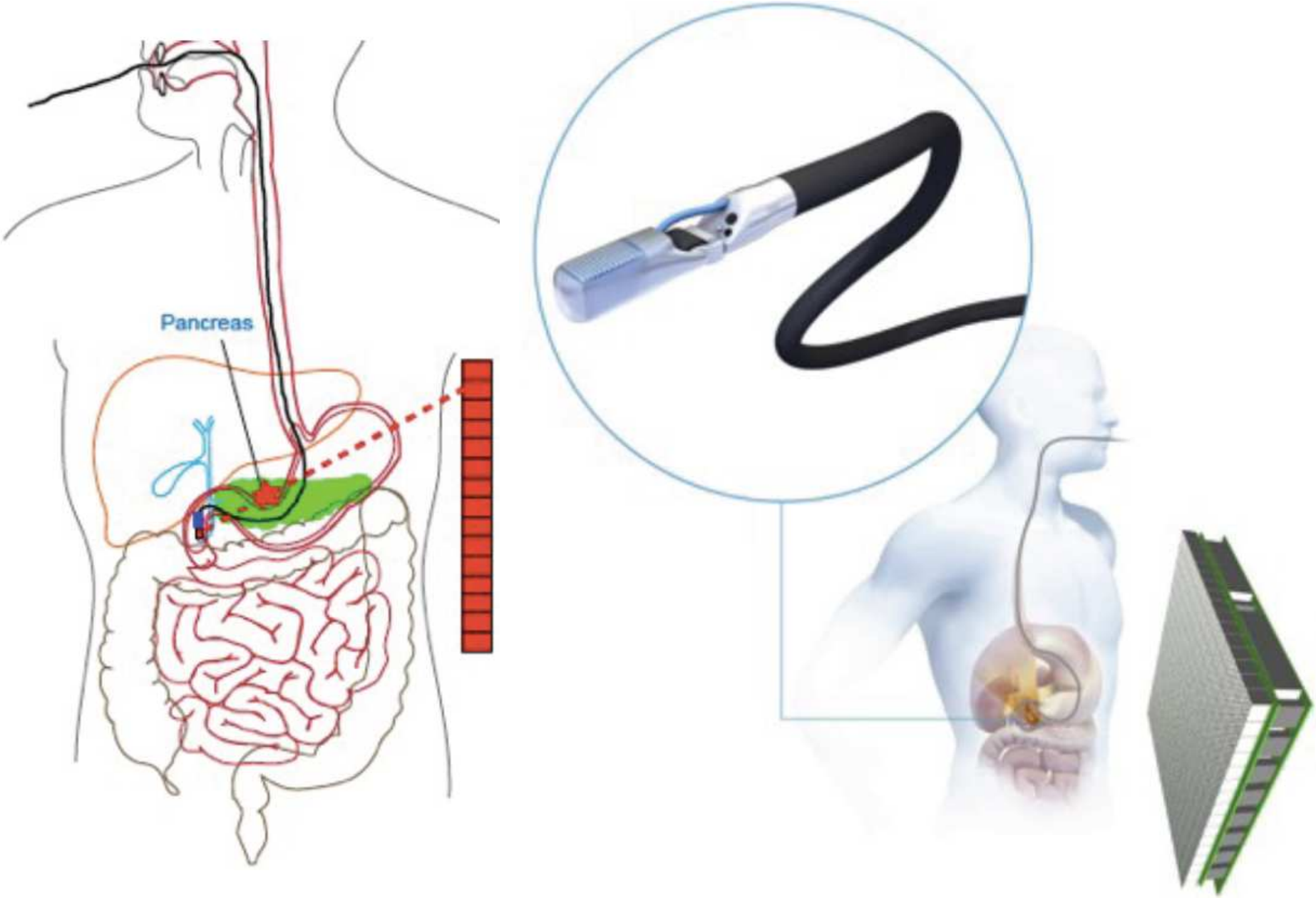
Challenge:

to detect small size tumors in large background environment … (e.g. liver, heart, bladder)

Goal:

to improve resolution of PET images

How endoscopic PET work?



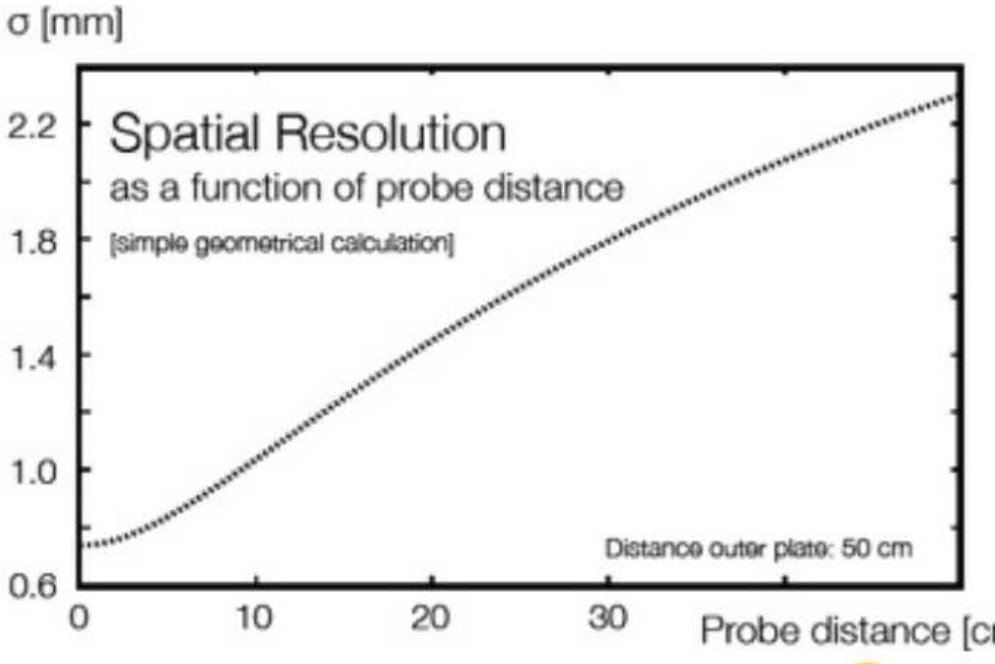
Why Endoscopic?

PET image resolution:

$$\sigma^2 \propto r^2 + (d/2)^2 + (.0022D)^2$$

r : Positron range [ca. 0.5 mm]
d : Detector size [ca. 1.0 mm; inner probe]
D : Detector distance

[see e.g. R.Lecomte, NIM A 526]
[zero position decoding error]



Why Time-of-Flight?

Sensitivity improvement:

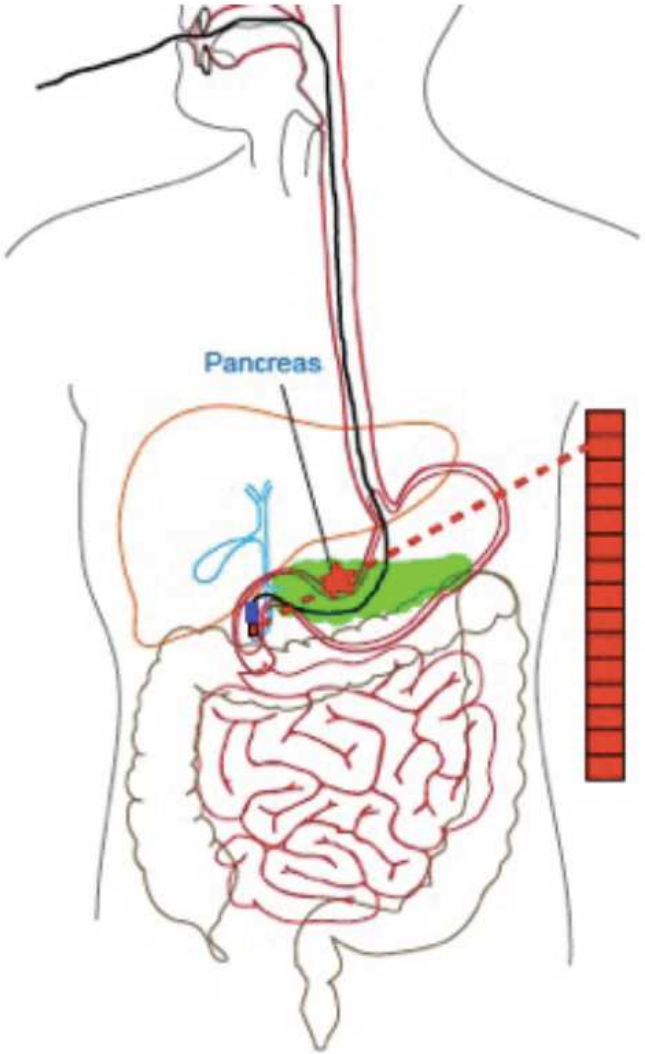
$$SNR^2_{TOF} \propto \frac{S}{\Delta x} \times SNR^2_{non\text{-}TOF}$$

S : Size of patient
Δx : Source localization using ToF

[M.Conti, Eur. J Nucl. Med Mol. Imag. 38 ...]

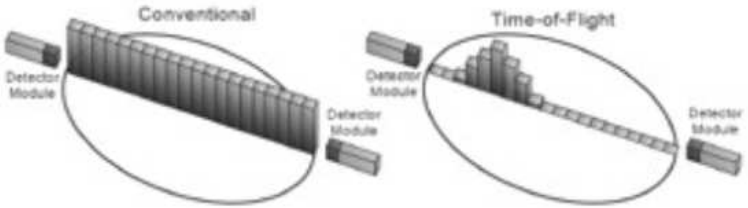
SNR: signal-to-noise ratio

How does endoscopic PET work?

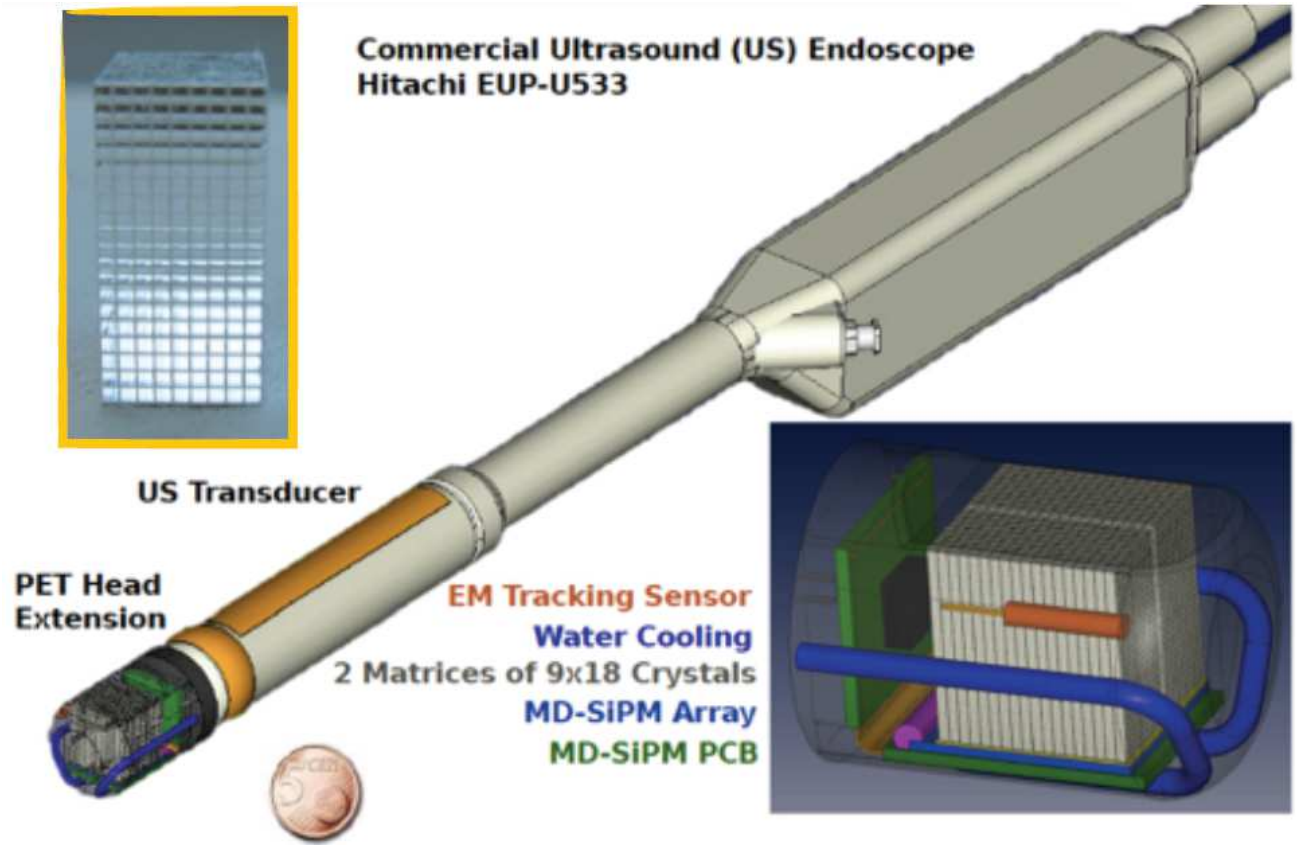


PET image from the line of response obtained between two detectors in coincidence

1) External PET plate
2) Internal PET head mounted on the tip of an endoscopic US transducer



Time of Flight: to reject false coincidences from near by organs.



http://physikseminar.desy.de/hamburg/seminars_in_2014/april_15_2014